SARDAR PATEL UNIVERSITY
Programme & Subject: M.Sc (Physics)
Semester: IV
Syllabus with Effect from: June - 2014

Paper Code: PS04EPHY06	Total Credit: 4
Title Of Paper: Computational Physics - II	

Unit	Description in detail	Weightage (%)
I	Molecular dynamics simulations: General behaviour of a classical system. Basic methods for many – body systems Theverlet algorithm. Structure of atomic clusters The Gear predictor – corrector method Constant pressure, temperature and bond length Structure and dynamics of real materials Ab initio molecular dynamics.	25%
II	Modeling continuous systems: Hydrodynamic equations The basic finite element method The Ritz variational method Higher-dimensional systems The finite element method for nonlinear equations The particle-in-cell method Hydrodynamics and magneto Hydrodynamics The Boltzmann lattice-gas method.	25%
III	Monte Carlo simulations: sampling and integration The metro algorithm Applications in statistical physics. Critical slowing down and block algorithms. Variational quantum Monte Carlo simulations Green's function-Monte Carlo simulations. Path – integral Monte Carlo simulations. Quantum lattice models.	25%
IV	Numerical renormalization: Scaling concept. Renormalization transform Critical phenomena: Ising model Renormalization with Monte Carlo simulation, Kondo problem Quantum lattice renormalization. Density matrix renormalization.	25%

Basic Text & Reference Books:-

- An introduction to computational physics Tao Pang, Cambridge University Press, 1997
- A first course in computational physics Paul L. Devries, John-Wiley & Sons Inc., New York, 1994